STATUS OF ATLANTIC SALMON IN SALMON FISHING AREAS (SFAs) 19-21 and 23

Context

Atlantic salmon populations of the Maritimes Region have experienced two or more decades of decline. Atlantic salmon commercial fisheries were closed by 1985. In-river closures of recreational fisheries began in 1990 in the inner Bay of Fundy and expanded to all outer Bay (Salmon Fishing Area, SFA 23) and many eastern and southern shore rivers (SFAs 20 and 21) by 1998. In addition, Aboriginal communities have either reduced or curtailed their fishing activity. Many populations are extirpated, and inner Bay of Fundy salmon (SFA 22 and a portion of 23) are listed as endangered under the Species at Risk Act. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is currently reviewing the conservation status of Atlantic salmon in Canada. In the Maritimes Region, there are thought to be four large groupings of salmon: the outer Bay of Fundy (western part of SFA 23), the Nova Scotia Southern Upland (SFAs 20 and 21), inner Bay of Fundy (SFAs 22 and part of 23), and eastern Cape Breton (SFA 19) areas.

Science advice on the status of salmon in SFAs 19-21 and 23 was requested by Fisheries and Aquaculture Management (FAM) on 14 January, 2010. This advice is required in advance of the 2010 advisory committee meetings. These are the formal consultative forums at which DFO solicits input from stakeholders prior to developing the 2010 recreational salmon fishing plan. This advice is also used to inform Aboriginal groups of the status of the salmon resource in advance of developing harvest agreements. Given that this document contains an update of previous advice using established methods, it was decided to provide this status report through the Science Special Response Process. A meeting was held by DFO Maritimes Science (February 22, 2010) to review the information in this document. This Science Response report is a product of that meeting.

Evaluation of the status of Atlantic salmon in the Maritime Provinces is based on a comparison of the abundance of salmon relative to a reference point known as the conservation spawner requirement (CSR). The CSR is generally a river-specific estimate of the number of salmon, based on the amount of fluvial (of suitable gradient) habitat, and biological characteristics of salmon, required to produce an egg deposition of 2.4 eggs/m^2 of habitat (the corresponding egg deposition is referred to as the conservation egg requirement). The CSR was originally adopted by the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) as the level below which CAFSAC would strongly advise that no fishing should occur. CAFSAC considered that this level provided a modest margin of safety but that the possibility of irreversible damage to the stock increased the further spawning escapement was, and the longer it remained, below the CSR, even at levels only slightly below (CAFSAC 1991).

Analyses and Responses

Eastern Cape Breton (SFA 19)

Salmon population monitoring in eastern Cape Breton is currently focused on four major river systems: **Middle, Baddeck, North, and Clyburn** (Appendix 1). Grand River was assessed annually in the past, but this assessment has been discontinued because neither fish counts nor recreational catch data are available for this river. Diver counts in the North Aspy and Skye rivers were carried out in 2009.

Assessments of salmon by DFO in SFA 19 are based on recreational catches, which are reported through a license-stub return program, as well as fishery-independent counts of adult salmon by diver surveys in Middle, Baddeck and North rivers. Parks Canada monitors adult abundance on the Clyburn River using similar diver surveys. Within Eastern Cape Breton, over 97% of the annual recreational fishing effort takes place on the Baddeck, North and Middle rivers.

Prior to 1998, recreational fishing was open from June 1st to October 31st in eastern Cape Breton. Since 1998, with the exception of the North River, the season has been shortened with the implementation of a mid-season warm water closure (July 16th – August 31st, Appendix 2). However, in 2009, all rivers within SFA 19 were closed during the fall, with the exception of North, Baddeck and Middle rivers, which were open to catch-and-release angling from September 16th to October 31st (Appendix 2).

Status

Data available for assessing the status of salmon in **Middle River** include annual recreational catch estimates from license stub returns and counts of adult salmon made during dive surveys, as well as intermittent electrofishing data. The conservation requirement for Middle River is 2.07 million eggs, calculated based on an estimated 864,600 m^2 of habitat and a target egg deposition density of 2.4 eggs/m^2. This egg deposition is expected from about 470 large and 80 small salmon.

Data from the recreational fishery was collected from salmon license stub returns for the years 1983 to 2009, with large salmon (63 cm or larger) and small salmon (less than 63 cm) being recorded separately. The data include the number of salmon caught and released, the number harvested and fishing effort in each year. Effort is estimated in rod days where any portion of a day fished by one angler is recorded as one rod day. Values are adjusted for non-returned stubs using a relationship based on the reported catch as a function of the number of reminder letters sent to licensed anglers. The preliminary estimates (Appendix 3) of the recreational catch in 2009 were 10 small and 99 large salmon and an estimated effort of 499 rod days. Both the effort and catch of large salmon are higher than in 2008, whereas the estimated catch of small salmon is lower. In 2009, nine salmon were removed from the population for use as broodstock for a stocking program to offset anticipated future losses to the population from catch-and-release mortality. In addition, 40 parr were collected for grow-out to adults to offset an Aboriginal harvest (an allocation of 10 grilse).

The numbers of large and small salmon counted during dive surveys in Middle River from 1989 to 2009 provide indices of spawning escapement for this population. These surveys typically take place during the last week of October, just prior to the end of the fishing season. During the dive survey in 2009, 39 small and 97 large salmon were counted, values that were lower than those from 2008.

An abundance time series for Atlantic salmon in Middle River was derived using a model that combines the recreational catch, dive survey, adult mark-recapture and electrofishing data to estimate abundance using maximum likelihood (Gibson and Bowlby 2009). The resulting time series (Figure 1) shows an increasing trend until 1989, followed by a gradual decrease to present. The spawning escapement in 2009 is estimated to be 168 large salmon and 64 small salmon, down from 219 large salmon and 138 small salmon in 2008.

Estimates of the percent of the conservation requirement met annually (Figure 1) show a similar pattern with very little chance that the population has met its conservation requirement at any time since 1989. An assumption of a 4% catch-and-release mortality is used in the assessment model. Based on the preliminary estimated recreational catch, the number of mortalities resulting from the recreational fishery is estimated to be 4 to 5 salmon. The percent of the conservation requirement met in 2009 is estimated to be 29.3%. Overall, the analyses indicate a stable or slightly declining abundance trend with the population typically in the range of 19% to 65% of its conservation requirement over the last 10 years.

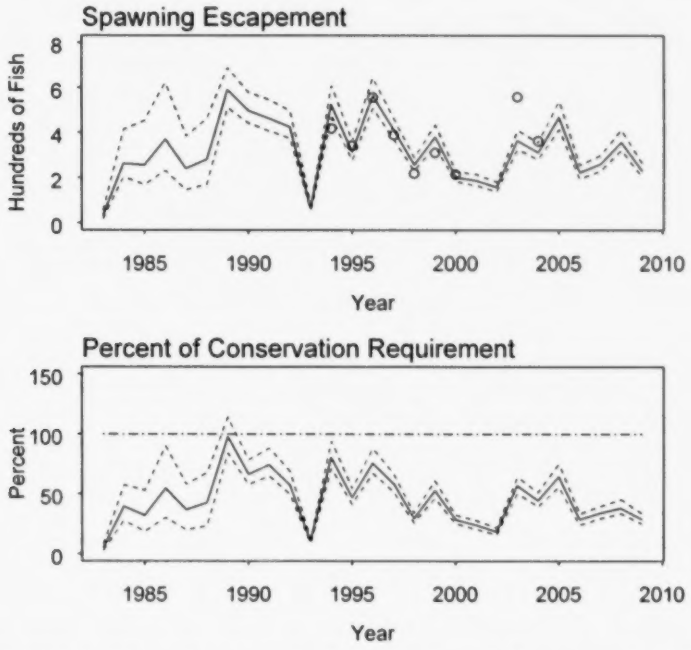

Figure 1. Estimated total number of spawners (top panel) and the percent of the conservation requirement attained (bottom panel) in Middle River, NS, from 1983 to 2009. The solid lines are the estimated values and the dashed lines are the 10th and 90th percentiles of the posterior probability densities for the estimates (indicative of the uncertainty of the estimates). The points in the upper panel are the population estimates obtained by mark recapture during the dive surveys. The horizontal dashed line in the bottom panel indicates 100% of the conservation requirement.

The assessment methods and data available for Atlantic salmon in **Baddeck River** are similar to those for Middle River. The conservation requirement for the Baddeck River is 2.0 million eggs, calculated based on an estimated 836,300 m^2 of habitat and a target egg deposition density of 2.4 eggs/m^2. This egg deposition is expected from about 450 large and 80 small salmon.

In 2009, the preliminary estimate (Appendix 3) of the recreational catch was 10 small salmon and 123 large salmon with an estimated effort of 448 rod days. Both the effort and catch of large salmon are higher than in 2008, whereas the estimated catch of small salmon is lower. In 2009, nine salmon were removed from the population for use as broodstock for a stocking program to offset anticipated future losses to the population from catch-and-release mortality. In addition, 40 parr were collected for grow-out to adults to offset an Aboriginal harvest (an allocation of 10 grilse).

The numbers of large and small salmon counted during dive surveys in Baddeck River from 1994 to 2009 provide indices of spawning escapement for this population. These surveys typically take place during the last week of October, just prior to the end of the fishing season. During the dive survey in 2009, 15 small and 67 large salmon were counted, values that were lower than those from 2008.

Annual estimates of salmon escapement after the recreational fishery (Figure 2) show an increasing trend until 1996, followed by a decrease. The spawning escapement in 2009 is estimated to be 129 large salmon, similar to the 2008 estimate of 126 large salmon, and 26 small salmon, down from 109 small salmon in 2008.

Estimates of the percent of the conservation requirement met annually (Figure 2) show a similar pattern with very little chance that the population has met its conservation requirement since 1983. Based on the preliminary estimated recreational catch, the number of mortalities as a result of the recreational fishery in the Baddeck River is estimated to be 4 to 5 salmon. The percent of the conservation requirement met in 2009 is estimated to be 34%. Overall, the analyses indicate a roughly stable abundance trend with the population in the range of 21% to 57% of its conservation requirement over the last 10 years.

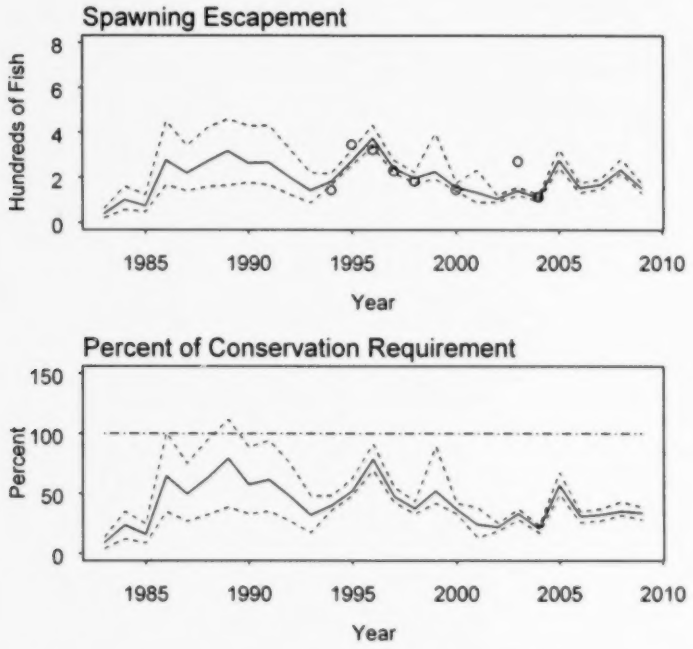

Figure 2. Estimated total number of spawners (top panel) and the percent of the conservation requirement attained (bottom panel) in Baddeck River, NS, from 1983 to 2009. The solid lines are the estimated values and the dashed lines are the 10th and 90th percentiles of the posterior probability densities for the estimates (indicative of the uncertainty of the estimates). The points in the upper panel are the population estimates obtained by mark recapture during the dive surveys. The horizontal dashed line in the bottom panel indicates 100% of the conservation requirement.

Similar to the Middle and Baddeck rivers, recreational catch estimates from license stub returns and counts of adult salmon made by divers are available for assessing the status of salmon in **North River**. The conservation requirement for the North River is based on an estimated 382,700 m^2 of habitat and a target egg deposition rate of 2.4 eggs/m^2. The requirement of 0.85 million eggs is expected from about 200 large and 30 small salmon.

In 2009, the preliminary estimate (Appendix 3) of the recreational catch was 65 small salmon and 191 large salmon with an estimated effort of 584 rod days. The effort in 2009 was slightly higher than in 2008. The catch of large salmon was higher; whereas, the catch of small salmon was lower.

Dive counts in North River are not conducted every year because of water conditions. A count was done in 2009 during the last week of October, during which 62 large salmon and 15 small salmon were observed. Counts have been completed in 6 years since 2001 and have ranged from 12 to 117 salmon. Counts from 1994 to 1998 ranged from 167 to 335 salmon.

Returns to North River in 2009 were estimated using the preliminary recreational catch data and mean catch rates (ratio of the recreational catch to the estimated returns) for this river. Based on these rates (0.41 for large and 0.69 for small salmon), the estimated returns are 468 large and 95 small salmon. The large salmon estimate is similar to that for 2008; whereas, the estimate for small salmon is slightly more than half the 2008 value. Based on the preliminary estimated recreational catch, the number of mortalities as a result of the recreational fishery in North River (4% mortality rate assumed) is estimated to be 10 to 11 salmon. This population

has shown a declining trend since the 1980s, but based on the recreational catch, appears to be above its conservation requirement at present (Figure 3).

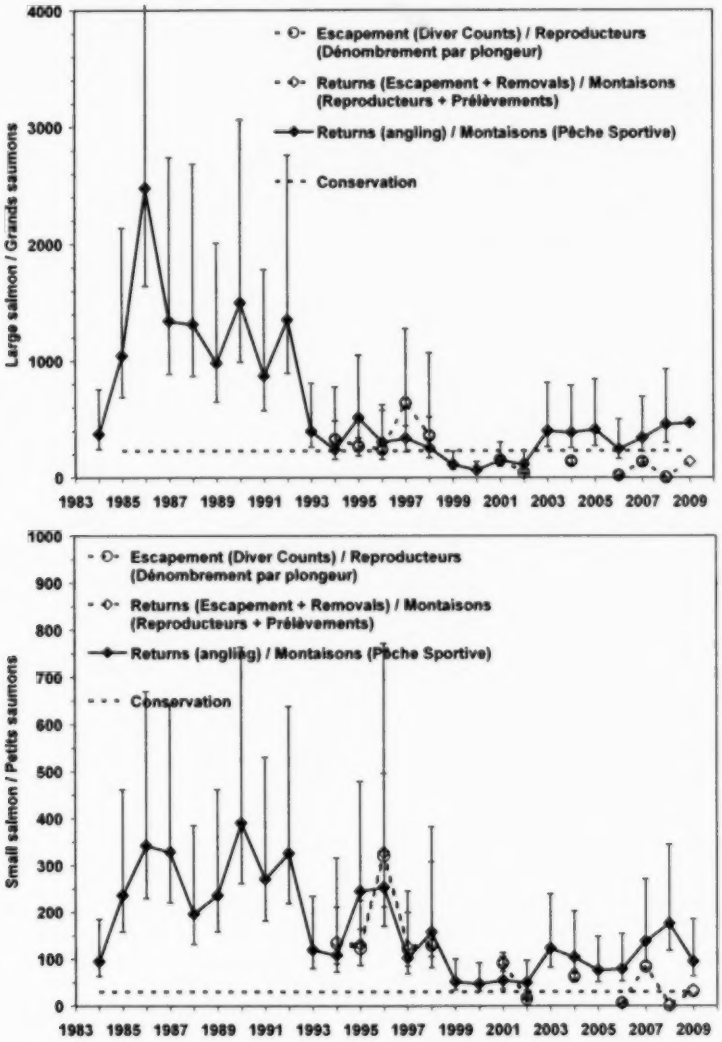
Large salmon / Grands saumons
Escapement (Diver Counts) / Reproducteurs (Dénombrement par plongeur)
Returns (Escapement + Removals) / Montaisons (Reproducteurs + Prélèvements)
Returns (angling) / Montaisons (Pêche Sportive)
Conservation
Small salmon / Petits saumons
Escapement (Diver Counts) / Reproducteurs (Dénombrement par plongeur)
Returns (Escapement + Removals) / Montaisons (Reproducteurs + Prélèvements)
Returns (angling) / Montaisons (Pêche Sportive)
Conservation
1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009

Figure 3. Estimates of the number of salmon returning to spawn and the spawning escapement for large and small salmon in the North River, NS, as derived from diver counts and from recreational catch data. The expected number of large or small salmon necessary to meet the conservation requirement is shown by the horizontal dashed line. Error bars are 90% confidence intervals.

Clyburn Brook is found on the eastern side of Cape Breton Highlands National Park near Ingonish. The river runs over a length of 19.4 km and is estimated to contain 116,500 m^2 of habitat. Parks Canada has conducted annual dive surveys on this river from 1987 to 2009. The counts of large and small salmon are done at the end of the fishing season. Although the observation efficiency is not known, the time series provides a relatively consistent index of abundance for this river, although in some years less area is covered during the survey than in

others. Counts in this river were highest in 1987 at 175 salmon (Figure 4) and have only exceeded 20 salmon twice since 1999.

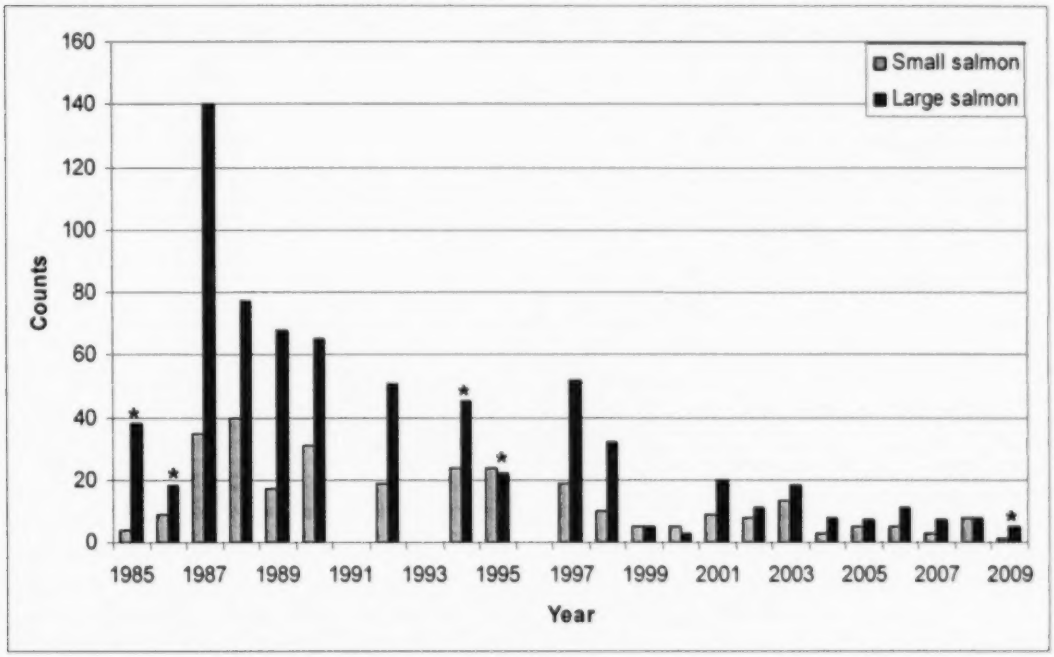

Figure 4. Counts of large and small salmon in Clyburn River, NS, from 1985 to 2009. Only the lower section of the river was surveyed (partial counts) in some years.*

The status of salmon in the **North Aspy River** was assessed by a diver survey for the first time in 2009. The observation rate by diver surveys on other index rivers in SFA 19 ranges from 0.485 to 0.608. Given that the North Aspy is somewhat narrower and clearer than the other rivers, the observation rate may be higher. During the dive survey in 2009, 28 small salmon and 126 large salmon were counted. The North Aspy River is likely above its conservation requirement of 673,721 eggs (equating to about 24 small and 158 large salmon).

A dive survey was also attempted in **Skye River** (including the **Indian River** tributary) for the first time in 2009. Three large and two small salmon were counted in 2009. The representativeness of this count is questionable due to the small river size, poor visibility, and the potential for salmon to hold in remote areas that were not surveyed, so no inferences can be drawn from the 2009 swim-through.

In 2009, a preliminary estimate (Appendix 3) of the number of salmon caught and released in SFA 19 was 506 fish. Assuming a 4% catch-and-release mortality rate, 20 to 21 salmon are estimated to have died as a result of the recreational fishery in SFA 19 in 2009.

Southern Upland of Nova Scotia (SFAs 20 and 21)

The Southern Upland (SU) region includes all rivers on the Eastern shore and Southwest Nova Scotia draining into the Atlantic Ocean. It has been divided into two Salmon Fishing Areas (SFAs) for management purposes: SFA 20 (Eastern shore) and SFA 21 (Southwest Nova Scotia) (Appendix 2). Within the previous century, 63 rivers in the Southern Upland are known

to have supported anadromous Atlantic salmon populations. Based on pH samples collected in the early 1980s, at least 14 of these rivers were heavily acidified (pH < 4.7) and were no longer able to support salmon (DFO 2000). A further 20 rivers were partially acidified (pH ranges from 4.7 to 5.0) and were thought to support only remnant populations. A region-wide electrofishing survey in 2000 found salmon in 28 of 52 rivers (54%). A similar survey in 2008 and 2009 found salmon in only 21 of 54 rivers (39%).

Atlantic salmon assessment activities in the SU region are focused primarily on two populations: the St. Mary's River, the index population for SFA 20, and the LaHave River, the index population for SFA 21 (Appendix 1).

Status

The **St. Mary's River** is one of the major river systems in SFA 20 and consists of two main branches: the West and East. Assessment activities in the St. Mary's River are focused on the West Branch of the river, which contains 55% of the juvenile salmon habitat available in the watershed. The conservation requirement for the entire river is 7.4 million eggs, which is equivalent to approximately 3,155 adult salmon.

Escapement estimates (Table 1) for the river are based either on the recreational catches (1996 and earlier), or on adult mark-recapture experiments (1997 to 2001 and 2006 to 2008) in the West Branch. From 2002 to 2005, mark-recapture experiments were attempted but were unsuccessful, and escapement estimates in these years were derived using the mean catch rate for seining during years when the mark-recapture experiments were successful. Mark-recapture experiments had to be cancelled in 2009 due to high river water levels. Two sites were attempted: one under marginal conditions and the other under good conditions and no salmon were captured or observed in either case. The ratio of escapement estimates for the West Branch of the St. Mary's relative to the LaHave River above Morgan Falls for the past 5 years ranges from 0.40 – 0.64 (mean 0.52). Under the assumption that this ratio is the same in 2009, the escapement estimate for 2009 for the West Branch of the St. Mary's River is 114 adult salmon. Applying separate ratios for one-sea-winter (1SW – almost all small salmon) and multi-sea-winter (MSW – almost all large salmon) salmon yields a similar escapement estimate: 96 1SW and 15 MSW, respectively (Table 1). Since 1995, the ratio of salmon in the West Branch to the count at Morgan Falls has not exceeded 1.15. If this ratio was used, the spawning escapement in the West Branch of the St. Mary's River in 2009 would be 253 salmon (size categories combined). There is no evidence that adult salmon abundance is significantly higher in the East Branch of the St. Mary's River.

Table 1. Estimated escapement of one-sea-winter (1SW) and multi-sea-winter (MSW; including both two-sea-winter and repeat spawning salmon) Atlantic salmon relative to the conservation requirement in the West Branch of the St. Mary's River for the years 1995 to 2009.

Year	1SW	MSW	% Conservation Requirement
1995	1,121	240	78
1996	844	325	67
1997	390	61	26
1998	1,059	41	63
1999	307	83	22
2000	315	25	20
2001	319	106	24
2002	220	16	14
2003	600	122	42
2004	464	23	28
2005	192	8	12
2006	222	18	14
2007	182	23	12
2008	361	36	23
2009	96	15	7

In 2009, the recreational salmon fishery on the St. Mary's River was closed on the West Branch above the highway bridge on Glenelg (Appendix 2). A preliminary estimate of the number of salmon caught and released in other parts of the river is 116 fish (Appendix 3). Assuming a 4% catch-and-release mortality rate, 4 to 5 salmon (size groups combined) are estimated to have died as a result of the recreational fishery in the St. Mary's River in 2009.

The smolt migration from the West Branch of the St. Mary's River was monitored using a smolt wheel deployed at the Glenelg Bridge, and their abundance was estimated using mark-recapture techniques. The population estimate for smolts in the West Branch of the St. Mary's River for 2009 was estimated to be 14,820 (95% C.I. = 8,600 to 28,001) with a smolt-wheel capture efficiency of 2.6%. This is slightly below the 2008 estimate of 15,217 (95% C.I. = 9,451 to 24,154). Based on an estimated 1,692,900 m^2 of juvenile habitat contained in the West Branch of the St. Mary's River, smolt production in 2009 was estimated to be 0.88 smolts per 100 m^2. This estimated value is well below the value of 3.8 smolts per 100 m^2 of habitat for a healthy salmon population (Symons 1979).

Based on electrofishing data from 16 sites in 2009, estimated densities (fish per 100 m^2) of age-0 (fry), age-1 and age-2 and older juvenile salmon were 11.3, 3.0 and 0.2 respectively for the entire St. Mary's River, which is higher than 2008 for fry (6.1), age-1 (2.5) and age-2 and older (0.3) parr.

In order to ensure that intervention programs, such as Supportive Rearing or Live Gene Banking, remained as options for trying to maintain the St. Mary's salmon population in case of future decline, DFO collected juvenile salmon (fry and parr) from the St. Mary's River in 2006 and 2007 for rearing at the Coldbrook Biodiversity facility. These collections were undertaken as an "insurance policy" to ensure that fish were collected while there was still sufficient genetic diversity in the event that an intervention would be necessary to slow population decline. In 2008, 201 of the collected juveniles reached maturity and were released at four sites on the

St. Mary's River so they could spawn naturally. In 2009 a further 212 adult salmon that had reached maturity were released at eight sites along the West Branch and its tributaries.

Assessment activities on the **LaHave River**, the index river for SFA 21, include counts of salmon ascending a fish ladder at Morgan Falls, smolt abundance estimates at Morgan Falls and juvenile densities obtained by electrofishing. The population above Morgan Falls increased as a result of improved fish passage with the construction of a fish ladder in the late 1960s. Salmon were stocked in the river above Morgan Falls to augment population growth, but stocking was terminated in 2005. The conservation requirement for the LaHave River above Morgan Falls is 1.96 million eggs, equivalent to roughly 1,320 salmon of typical characteristics for this run. On a per unit area basis, the conservation requirement is lower than that for other rivers in the Maritimes.

The total count of adult salmon at the Morgan Falls fishway on the LaHave River in 2009 was 220 fish (168 small and 52 large salmon), none of which were of hatchery origin (Figure 5). This represents a marked decrease from returns in 2008. Estimated egg deposition above Morgan Falls decreased to 474,771 eggs in 2009 or 24% of the conservation requirement (Figure 6).

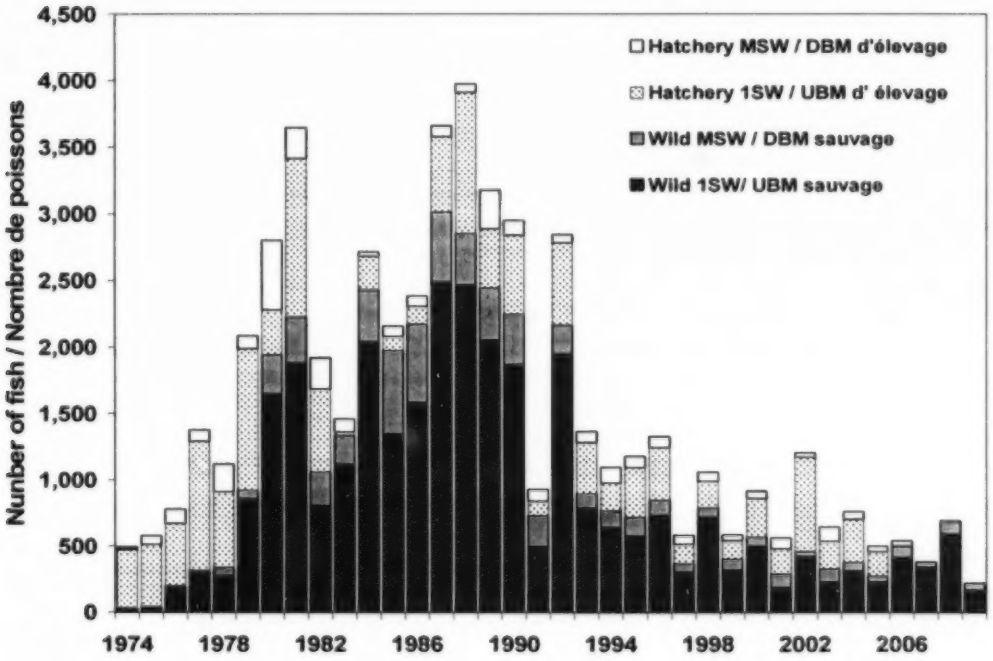

Figure 5. Counts of Atlantic salmon at Morgans Falls fishway on the LaHave River, NS, from 1974 to 2009 by wild-origin and hatchery-origin 1SW and MSW adults.

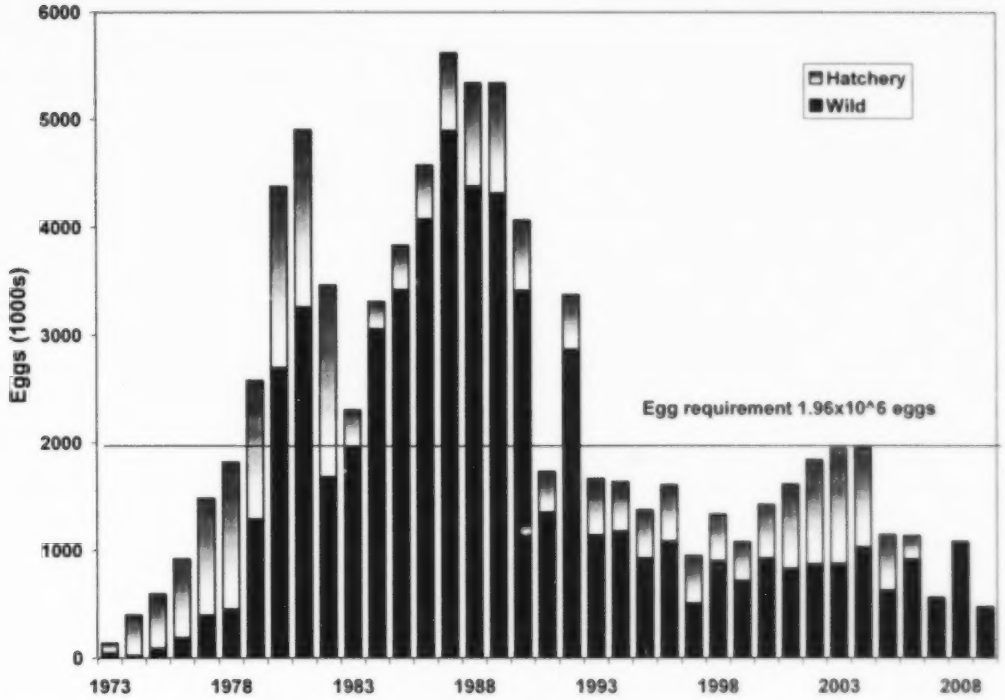

Figure 6. Estimated egg deposition (1000's) relative to the conservation requirement by wild and hatchery Atlantic salmon above Morgans Falls from 1973 to 2009.

In 2009, a preliminary estimate of the number of salmon caught and released in LaHave River was 52 fish (Appendix 3). Assuming a 4% catch-and-release mortality rate, 2 salmon are estimated to have died as a result of the recreational fishery in this river in 2009.

In 2009, a total of 8,644 wild smolts (95% C.I. = 7,763 to 9,659) were estimated to have emigrated from above Morgan Falls, a 40% decline from the 2008 value and less than the 1996-2008 mean of 16,424.

Outer Bay of Fundy (SFA 23)

The outer Bay of Fundy Rivers in SFA 23 include those between the Saint John River and its tributaries and the St. Croix River, and are bounded on the east by the "endangered" inner Bay of Fundy populations and on the west by some United States "endangered" populations. The entire SFA 23 has been closed to commercial fishing for Atlantic salmon since 1984. The continual failure of populations to achieve conservation requirements has resulted in the complete closures of the Aboriginal fisheries for food, social and ceremonial purposes, and the recreational fisheries since 1998. Assessment data in SFA 23 are collected for three index populations: the Saint John River upriver of Mactaquac Dam, Nashwaak River and Magaguadavic River. The Magaguadavic River data was provided by the Atlantic Salmon Federation. The St. Croix has been assessed annually in the past but the fishway has not been monitored since 2006.

The Mactaquac Biodiversity Facility (formerly Fish Culture Station) has been involved in the mitigation of salmon lost to hydroelectric projects on the Saint John River, primarily via smolt

production. Each year, hatchery broodstock for the program has come from 200-300 wild sea-run adults. The program at the Mactaquac Biodiversity Facility has been re-focused to the singular objective of conserving and restoring a declining resource. Thus, discussion within DFO and the Saint John River Management Advisory Committee and the Saint John Basin Board resulted in a program change to replace a large portion of the traditional smolt production with production of age-0 fall parr and captive rearing to broodstock of mostly wild-origin juvenile salmon for release and natural spawning upriver of Mactaquac. This new salmon conservation program resembles the one utilized for the endangered inner Bay of Fundy salmon populations.

Status

The conservation requirement for salmon populations **upriver of Mactaquac Dam** is based on an accessible rearing area of 13,472,200 m^2 with stream gradients between 0.12% and 5.0%. This excludes the Aroostook River, headponds, as well as the 21 million square meters of river with gradient <0.12% and represents about 37% of the total accessible salmon habitat (wetted area) within SFA 23. Based on a required egg deposition of 2.4 eggs/m^2, the conservation requirement is 32,330,000 eggs. The number of spawners necessary to obtain the conservation requirement is estimated to be 4,900 MSW and 4,900 1SW salmon.

Counts at Mactaquac Dam consist of fish captured at the fish collection facilities at the Mactaquac Dam and at the smolt migration channel at the Mactaquac Biodiversity Facility. During 2009, the fish collection facilities at the dam and the migration channel at the biodiversity facility were operated from May 15th to October 29th.

Total returns of 613 1SW and 558 MSW salmon destined for upriver of Mactaquac Dam on the Saint John River in 2009 were both well below returns observed in most years since 1970 (Figure 7). The 1SW returns (wild and hatchery combined) were the lowest on record since 1970. The MSW returns were higher than the previous four years but were still very low relative to past abundance. Wild origin fish comprised 71% of 1SW and 60% of MSW fish. Six repeat spawning captive reared salmon and two salmon suspected to be aquaculture escapes (based on fin condition and scale analysis) were also captured at the Mactaquac fishway in 2009.

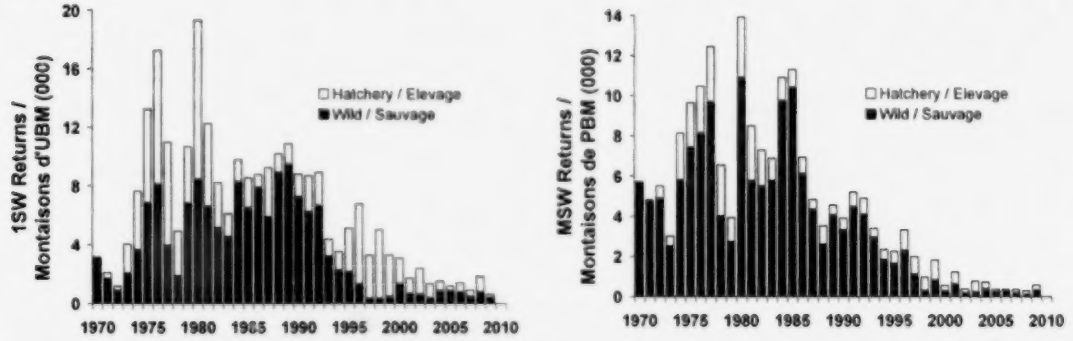

Figure 7. Estimated total returns of wild and hatchery 1SW and MSW salmon destined for upriver of Mactaquac Dam, Saint John River, 1970 - 2009.

Removals from the returns destined for production areas upriver of Mactaquac include: 1) the estimate of 1SW and MSW salmon ascribed to by-catch in the estuary, 2) salmon passed or trucked upriver of Tinker Dam on the Aroostook River, 3) salmon retained at Mactaquac as broodstock for conserving the Serpentine strain, 4) salmon estimated to have been lost to poaching activities, in particular those taken by illegal nets on the Tobique River, and 5) known mortalities

due to handling operations at Mactaquac, at fishways (Beechwood, Tobique and Tinker Dam) and at the Tobique Half Mile Barrier (Table 2).

Table 2. Estimated removals of 1SW and MSW salmon destined for upriver of Mactaquac Dam on the Saint John River, N.B., 2009.

	Estimated Removals		Percent of Total Returns	
Component	1SW	MSW	1SW	MSW
By-catch Estimates	6	14	1.0	2.5
Passed above Tinker Dam	11	5	1.8	0.9
Hatchery Broodfish	24	44	3.9	7.9
Poaching Estimates	6	2	1.0	0.4
Mortality at Mactaquac	1	16	0.2	2.9
Mortality at Beechwood	6	3	1.0	0.5
Mortality at Tobique	0	0	0.0	0.0
Mortality at Tinker	0	0	0.0	0.0
Mortality at Tobique Barrier	0	2	0.0	0.4
Total	54	86	8.8	15.4

The subsequent spawning escapement is estimated to be 559 1SW and 472 MSW salmon, 11% and 10% of the respective conservation requirements. The egg deposition estimate (58% from wild fish) was 9% of the requirement, a slight improvement over the previous four years but still the sixth lowest value on record (Figure 8). Captive reared adults, with the potential to produce an additional 4.7 million eggs (or 14% of the requirement) were released in the Tobique River in 2009 (Figure 8).

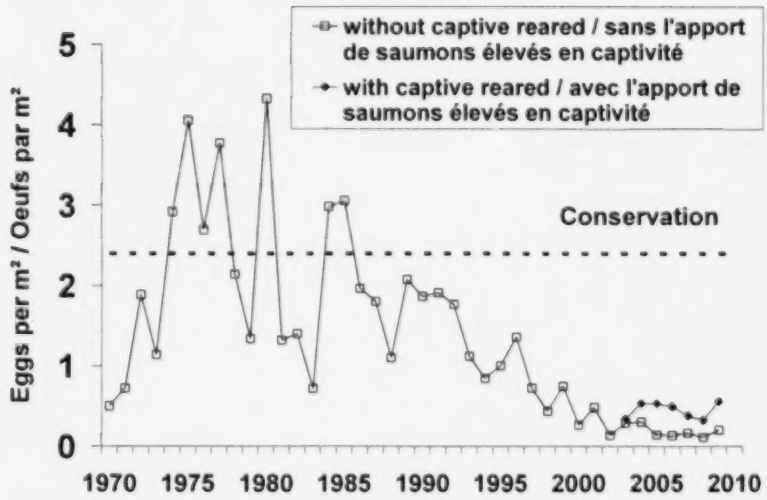

Figure 8. Estimated egg deposition upriver of Mactaquac Dam, Saint John River, 1970 - 2009.

The **Nashwaak River** is the largest single salmon-producing tributary of the Saint John River downriver of Mactaquac Dam, containing 28.5% of the total salmon production area in the Saint John River downriver of Mactaquac Dam. A salmon counting fence 23 km upriver from the

confluence with the Saint John River was operated by DFO in 1972, 1973 and 1975, and by DFO in cooperation with Aboriginal peoples from 1993 - 2009. In 2009, the fence was jointly operated by Kingsclear and Oromocto First Nations. Salmon production area upriver of the fence is estimated to be 5.35 million square meters (90% of the total river estimate) and the conservation requirement is 12.8 million eggs. The number of spawners necessary to obtain the conservation requirement is estimated at 2,040 MSW and 2,040 1SW salmon.

Counts of 199 1SW and 213 MSW salmon at the Nashwaak River fence, combined with seining of upriver holding pools, resulted in a mark-recapture return estimate of 297 1SW and 336 MSW salmon (Figure 9). MSW returns in 2009 were higher than any of the previous twelve years while the 1SW returns were equal to the second lowest since monitoring resumed in 1993.

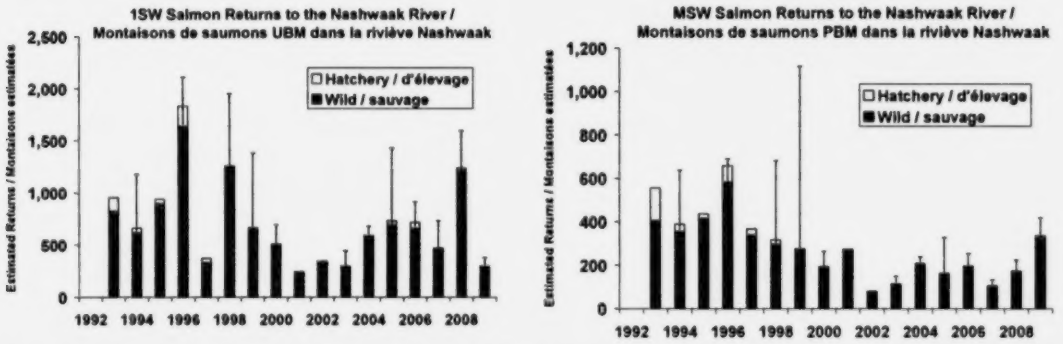

Figure 9. Estimated wild and hatchery 1SW and MSW salmon returns (and 2.5 and 97.5 percentiles) to the Nashwaak River, 1993-2009.

In 2009, 20 1SW salmon and seven MSW salmon were removed from the fence trap and transported to Mactaquac Biodiversity Facility for conservation initiatives by the Nashwaak Watershed Association Inc. There were two 1SW salmon mortalities observed while the counting fence was in operation in 2009. DFO fishery officers reported no illegal activities targeting salmon within the Nashwaak watershed. Therefore, no corrections were made for illegal removals. Spawners represented 13% and 16% of the respective 1SW and MSW conservation requirements. In 2009, the egg deposition estimate of 14% of the requirement was, with the exception of 2008, greater than or similar too the observed values in the past decade (Figure 10). One-sea-winter females contributed 14% of the total egg deposition. Hatchery fish contributed 4% of the total egg deposition.

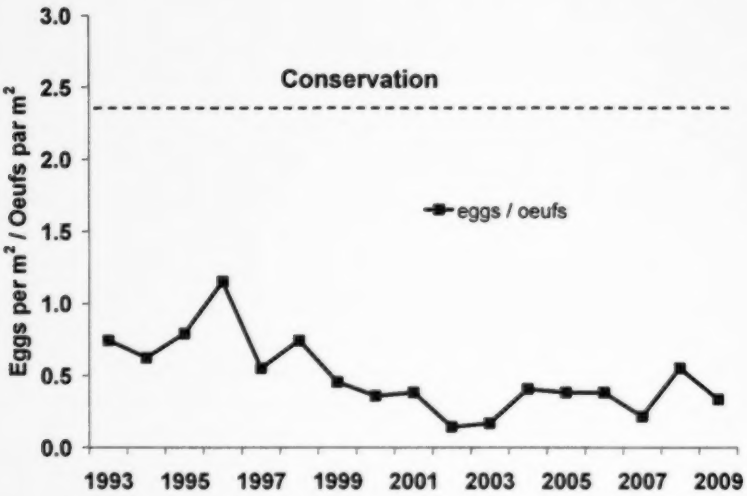

Figure 10. Estimated egg deposition upriver of the counting fence operated just below Durham Bridge, Nashwaak River, 1993 - 2009.

Wild smolt production has been monitored since 1998. The number of wild smolts emigrating from upriver of the adult counting fence in 2009 was estimated to be 15,900 (95% C.I. = 12,150 to 22,850). The total number of wild smolts increased by about 8,500 fish from 2008, was slightly above the previous five-year mean, and was the fifth highest estimate since smolt assessment commenced in 1998.

The return rate of the 2008 wild smolt class as 1SW salmon in 2009 was 3.9%, about 60% of the previous five-year mean (6.3%) and the second lowest value observed in the past six years. The return rate of the wild smolt class of 2007 as 2SW salmon in 2009 was 1.3% - the fourth highest return rate observed since the 2SW returns in 2000 and similar to the previous five-year mean (1.3%).

Returns to the St. George fishway and trap located near the head of tide on the **Magaguadavic River** in 2009 were 3 1SW and 3 MSW salmon. Aquaculture escapes in 2009 numbered 2 postsmolt, 13 1SW and 1 MSW salmon. The number of spawners necessary to obtain the conservation requirement is estimated at 140 1SW and 230 MSW salmon.

Sources of Uncertainty

The number of salmon harvested under Aboriginal fishing agreements in SFAs 19-21 is not available at the time of this assessment (Aboriginal fisheries in SFA 23 are currently closed). Removals resulting under these agreements are not thought to be substantial because allocations are low. There are anecdotal reports of poaching but its contribution to the depressed status of populations in this region is not known.

The number of salmon caught and released within the region is estimated based on salmon license stub returns. There are anecdotal (but reliable) reports of salmon being caught and released by anglers fishing with a general recreational fishing license. Although the extent to which this is occurring is not known, the number of salmon caught and released each year in recreational fisheries, and hence mortality associated with the fishery, is likely underestimated. Under reporting may also affect population estimates based largely on angling data.

Conclusions

Overall, the information presented in this report does not outline a positive view of status of Atlantic salmon in the eastern Cape Breton, Southern Upland or outer Bay of Fundy regions.

The available data and analyses for Southern Upland (SFA 20 and 21) populations indicate that some populations are presently extirpated and that the healthiest populations are at their lowest abundance levels on record. In the absence of human intervention, the likelihood that populations in this region will extirpate is thought to be high. Actions that improve freshwater productivity or smolt-to-adult survival are expected to increase viability and reduce recovery times once conditions are favourable for recovery.

Within the outer Bay of Fundy (SFA 23), populations in the Saint John River upriver of Mactaquac Dam require supportive rearing to prevent extirpation. Actions that increase or improve freshwater productivity or survival from smolt to spawning are expected to increase viability, reduce the dependency on supportive rearing, and reduce recovery times once conditions are favourable for recovery. These include: reducing the poaching that is occurring in the system, in particular near the Tobique Narrows Dam, and increasing smolt survival by reducing turbine mortalities at each of the hydroelectric facilities affecting the upriver populations.

The overall salmon population assemblage in eastern Cape Breton (SFA 19) is thought to be healthier than in the outer Bay of Fundy or Southern Upland regions. Salmon populations in the North River and North Aspy River are thought to be above their conservation requirement. Two other populations (Middle and Baddeck) appear to be stable but at abundance levels well below their conservation requirements. However, some populations in this region have shown declines during the last 15 to 25 years. The small size of many rivers in this area makes their populations more vulnerable to the demographic and genetic effects of small population size.

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Sources of Information

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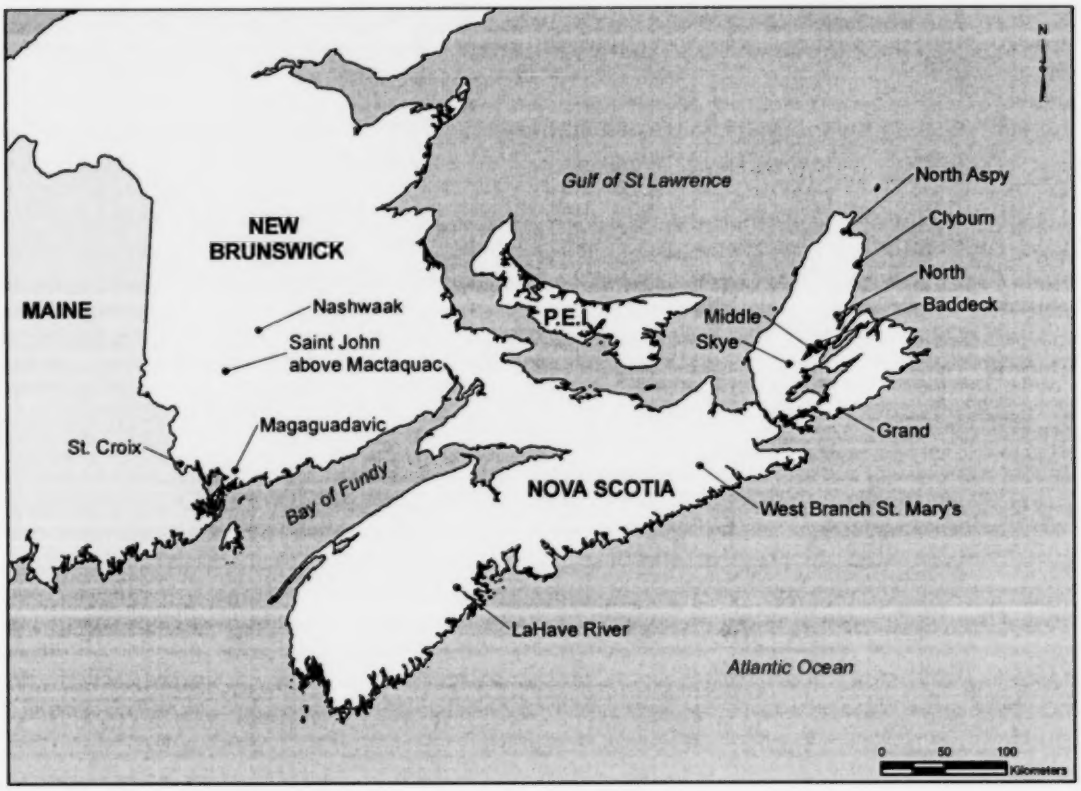
Appendices

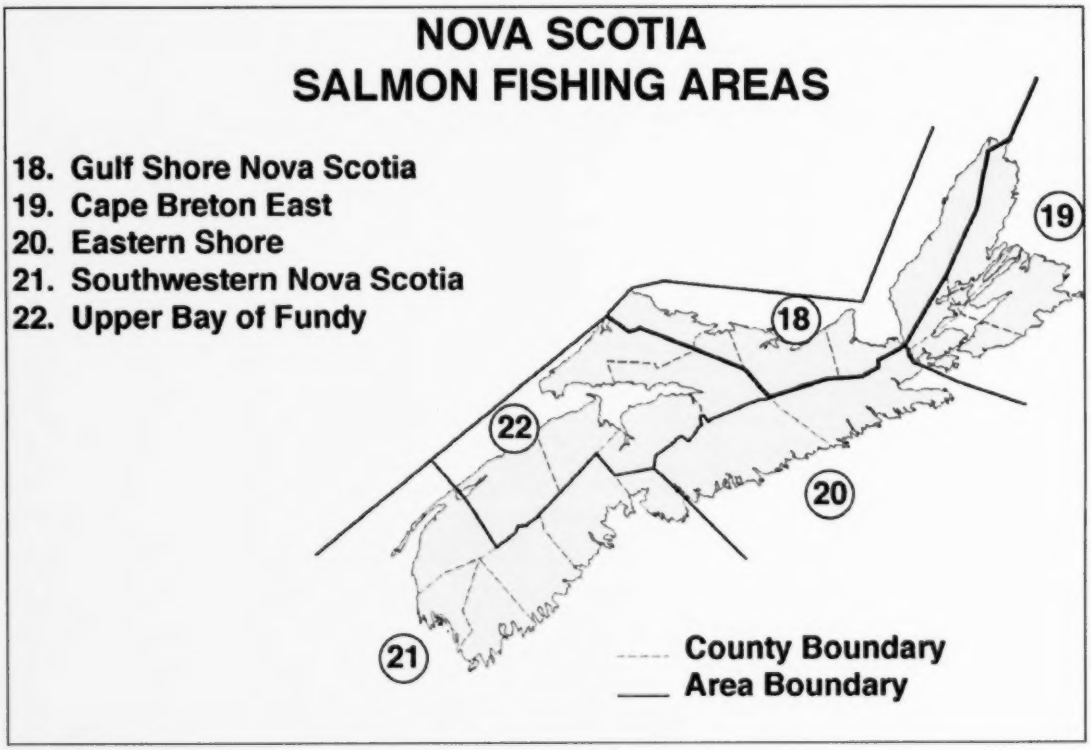
Appendix 1. Map showing the locations of Atlantic salmon rivers for which abundance time series are presented in this response.



Appendix 2: Fisheries and Oceans Canada Notice: 2009 Salmon Angling Seasons for Nova Scotia.

2009 SALMON ANGLING SEASONS (revised September 16)

The Regional Director-General, Maritimes Region, Department of Fisheries and Oceans wishes to advise the public of the following changes to seasons and bag limits for Atlantic salmon in Nova Scotia.



1 (a) SALMON FISHING AREA 18 (Gulf Shore of Nova Scotia)
and all waters of the Province flowing into that Area, except the waters referred to in paragraphs (b) to (j) ..... Sept. 1 to Oct. 31

(b) East River, Pictou County ..... Sept. 1 to Oct. 31

(c) West River, Pictou County ..... Sept. 1 to Oct. 31

(d) River Phillip ..... Sept. 1 to Oct. 31

(e) Wallace River ..... Sept. 1 to Oct. 31

(f) West River, Antigonish County ..... Sept. 1 to Oct. 31

(g) South River, Antigonish County ..... Sept. 1 to Oct. 31

(h) Margaree River, Northeast Margaree River, Southwest Margaree River and tributaries, except the waters referred to in paragraphs (i) and (j) ..... June 1 to Oct. 15

(i) Margaree River upstream from the highway bridges at East Margaree to the Big Intervale bridges on the Northeast Margaree River and upstream to the Scotsville highway bridge on the Southwest Margaree River, not including tributaries.....June 1 to Oct. 31
(j) Northeast Margaree River and tributaries upstream from the Big Intervale bridges.....Closed all year

NOTES FOR SALMON FISHING AREA 18

- **THE DAILY CATCH AND RETAIN LIMIT IS TWO GRILSE (SALMON LESS THAN 63 CM IN LENGTH).**
- **THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING FOUR.**
- **THE YEARLY CATCH AND RETAIN LIMIT IS FOUR GRILSE (SALMON LESS THAN 63 CM IN LENGTH).**
- **WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED FROM OCTOBER 1 TO OCTOBER 31, INCLUSIVE.**

2 (a) SALMON FISHING AREA 19 (Cape Breton East)
and all waters of the Province flowing into that Area, except the waters referred to in paragraphs (b) to (q).....catch and release only) June 1 to July 15
(b) Baddeck River.....(catch and release only) June 1 to July 15 and September 16 to October 31
(c) Catalone River.....(catch and release only) June 1 to July 15
(d) Framboise River.....(catch and release only) June 1 to July 15
(e) Gaspereau River.....(catch and release only) June 1 to July 15
(f) Gerratt Brook.....(catch and release only) June 1 to July 15
(g) Indian Brook, Eskasoni.....Closed all year
(h) Lorraine Brook.....(catch and release only) June 1 to July 15
(i) Marie Joseph River.....(catch and release only) June 1 to July 15
(j) Mira River.....(catch and release only) June 1 to July 15
(k) Salmon River.....(catch and release only) June 1 to July 15
(l) Grand River.....(catch and release only) June 1 to July 15
(m) Middle River.....(catch and release only) June 1 to July 15 and September 16 to October 31
(n) North River downstream from the area known as "The Benches" as marked by a Fishery Officer.....(catch and release only) June 1 to Oct. 31
(o) North River upstream from the area known as "The Benches".....Closed all year
(p) River Tillard.....(catch and release only) June 1 to July 15
(q) Inhabitants River.....(catch and release only) June 1 to July 15

NOTES FOR SALMON FISHING AREA 19

- **THE ANGLING SEASONS ARE OPEN TO CATCH AND RELEASE FISHING ONLY ON THE ABOVE SPECIFIED DATES AND ARE SUBJECT TO IN-SEASON ADJUSTMENTS.**
- **THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING TWO.**
- **WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.**

3 (a) SALMON FISHING AREA 20 (Eastern Shore)
and all waters of the Province flowing into that Area, except the waters referred to in paragraph (b) to (g).....Closed all year

(b) East River, Sheet Harbour.....June 1 to Sept. 30
(c) Musquodoboit River.....(catch and release only) June 1 to July 15
(d) Salmon River (Guysborough), downstream from the highway bridge at West Cooks Cove.....(catch and release only) July 1 to Sept. 30
(e) Salmon River (Guysborough), upstream from the highway bridge at West Cooks Cove.....Closed all year
(f) St. Mary's River, except the waters referred to in paragraph (g) .....(catch and release only) June 1 to July 15
(g) West River, St. Mary's, upstream from the highway bridge at Glenelg.....Closed all year

NOTES FOR SALMON FISHING AREA 20

- **THE ANGLING SEASONS ARE OPEN TO CATCH AND RELEASE FISHING ONLY ON THE ABOVE SPECIFIED DATES AND ARE SUBJECT TO IN-SEASON ADJUSTMENTS.**
- **THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING TWO.**
- **WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.**
- **SEE EXCEPTIONS FOR THE EAST RIVER, SHEET HARBOUR AT THE END OF THIS NOTICE.**

4 (a) SALMON FISHING AREA 21 (Southwestern Nova Scotia)
and all waters of the Province flowing into that Area, except the waters referred to in paragraphs (b) to (k).....Closed all year
(b) Clyde River.....May 10 to Sept. 30
(c) Jordan River.....May 10 to Sept. 30
(d) Mersey River.....May 10 to Aug. 15 and Sept. 1 to Sept. 30
(e) Sackville River.....(catch and release only) June 1 to July 15
(f) Mushamush River.....(catch and release only) June 1 to July 15
(g) LaHave River downstream from Morgan Falls.....(catch and release only) June 1 to July 15
(h) LaHave River upstream from Morgan Falls except the waters referred to in paragraph (i).....Closed all year
(i) LaHave River between the bridge on the Lower Branch Road (Varner's Bridge #2) in New Germany and the Cherryfield Bridge at Cherryfield, not including tributaries.....(catch and release only) June 1 to July 15
(j) Petite Rivière, downstream from Fancy Lake .....(catch and release only) June 1 to July 15
(k) Tusket River.....(catch and release only) June 1 to July 15

NOTES FOR SALMON FISHING AREA 21

- **THE ANGLING SEASONS ARE OPEN TO CATCH AND RELEASE FISHING ONLY ON THE ABOVE SPECIFIED DATES AND ARE SUBJECT TO IN-SEASON ADJUSTMENTS.**
- **THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING TWO.**
- **WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.**
- **SEE EXCEPTIONS FOR THE CLYDE, JORDAN AND MERSEY RIVER AT THE END OF THIS NOTICE.**

5 (a) SALMON FISHING AREA 22 (Upper Bay of Fundy)
and all waters of the Province flowing into that Area .....Closed all year

EXCEPTIONS

- THE FOLLOWING FOUR RIVERS ARE HIGHLY ACIDIC AND NATURAL SALMON PRODUCTION IS UNLIKELY. ALTHOUGH PREVIOUSLY MANAGED AS PUT AND TAKE FISHERIES, THERE HAS BEEN NO STOCKING OF SALMON IN THESE RIVERS
- FOR SOME TIME. THEY REMAIN OPEN TO RETENTION, BUT THE LIKELYHOOD OF CATCHING SALMON THERE IS REMOTE.
  - THE EAST RIVER, SHEET HARBOUR IN SALMON FISHING AREA 20
  - CLYDE, JORDAN AND MERSEY RIVERS IN SALMON FISHING AREA 21
- THE DAILY CATCH AND RETAIN LIMIT IS TWO GRILSE (SALMON LESS THAN 63 CM IN LENGTH)
- THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING FOUR.
- THE YEARLY CATCH AND RETAIN LIMIT IS FOUR GRILSE (SALMON LESS THAN 63 CM IN LENGTH).
- WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.

REMINDERS

FOR 2009 ANGLERS ARE REMINDED THAT

- FOR THOSE RIVERS ON WHICH RETENTION IS PERMITTED, THE YEARLY BAG LIMIT FOR ATLANTIC SALMON IS (4) GRILSE THAT MEASURE LESS THAN 63 CM FROM THE TIP OF THE NOSE TO THE FORK OF THE TAIL.
- SALMON FISHING IS ONLY PERMITTED USING ARTIFICIAL FLIES AND, IN CERTAIN LOCATIONS AT CERTAIN TIMES, ONLY WITH BARBLESS OR PINCHED BARB HOOKS.
- ALL SALMON 63 CM OR LONGER MUST BE RETURNED TO THE WATER IN A MANNER THAT CAUSES THE LEAST POSSIBLE HARM TO THAT FISH.

SEASONS AND BAG LIMITS MAY CHANGE AT ANY TIME FOR CONSERVATION REASONS AND SUBJECT TO ABORIGINAL HARVEST AGREEMENTS.

THE MARITIMES REGION CLOSE TIME VARIATION ORDER 2009-074 IS HEREBY REVOKED.

FOR FURTHER INFORMATION CONTACT THE LOCAL FISHERY OFFICER AND REFER TO MARITIMES REGION VARIATION ORDERS 2009- 074, 2009-075 AND 2009- 076

FAITH SCATTOLON
REGIONAL DIRECTOR-GENERAL
MARITIMES REGION

Appendix 3. Reported recreational catches in SFAs 19 to 21 for 2009 (preliminary: January 18th, 2010 database query), 2008, and the average catches for 2004-2008 time period. All salmon fisheries in SFA 22 and 23 were closed during this time period.

	2009 (preliminary)				2008				5-Year Mean (2004-2008)							
	Grilse		Salmon	Effort	Grilse		Salmon	Effort	Grilse				Salmon		Mean Effort	
	Retained	Released	Released	Rod-days	Retained	Released	Released	Rod-days	Retained	95% CI	Released	95% CI	Released	95% CI	Rod-days	95% CI
SFA 19: EASTERN CAPE BRETON ISLAND																
ACONI BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BADDECK	0	10	123	448	0	26	41	276	0.7	1.1	22.9	13.2	71.6	34.2	285.9	97.2
BARACHOIS	0	0	0	0	0	7	2	26	0	0	2.1	3.7	1.1	1.4	13.7	9.8
CATALONE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CLYBURNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	2
FRAMBOISE (GIANT LAKE	0	0	0	0	0	0	0	2	0	0	0.6	1.7	0.2	0.6	5.3	8.3
FRENCHVALE BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GASPEREAUX: C. BRETON CO.	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.9	1.2	2.6
GERRATT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND	0	3	3	34	0	7	0	31	0	0	11	7.7	0.7	1.2	28.4	11
GRANTMIRE BROOK	0	0	0	0	0	0	2	17	0	0	4.8	7	3.1	2.9	12.2	6.5
INDIAN BROOK				River Closed	0	5	0	19	0	0	2	3.4	0.3	0.9	11	7.3
INGONISH	0	0	0	0	0	0	0	0	0	0	0.6	1	1.6	3.7	2.5	2.8
INHABITANTS	0	0	0	0	0	2	2	10	0	0	4.5	2.8	8.1	9.3	19.3	21.8
LITTLE LORRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LORRAINE BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MACASKILL'S BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARIE JOSEPH	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1.4	1.1
MIDDLE: VICTORIA CO.	0	10	99	459	0	46	58	440	0	0	38.4	11.8	83.4	42.9	400.8	155
MIRA	0	0	0	0	0	0	0	0	0	0	0.3	0.7	0	0	10.8	23.3
NORTH ASPY	0	0	0	0	0	0	12	10	0	0	4.9	8.7	14	9.7	41.9	36.1
NORTH: VICTORIA CO.	0	65	191	584	0	122	186	555	0.3	0.7	79.1	35.8	149.3	39.6	487.2	58.6
NORTHWEST BROOK (RIVER RYAN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RIVER BENNETT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RIVER DENYS	0	0	0	0	0	0	0	0	0	0	0.3	0.8	0	0	0.9	2.5
RIVER TILLARD	0	0	0	0	0	0	0	0	0	0	0.6	1.8	0.3	0.9	1.8	3.4
SAINT ESPRIT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SALMON: CAPE BRETON CO.	0	0	0	0	0	0	0	17	0	0	0.5	0.9	0.8	1.1	16.1	16.1
SKYE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SYDNEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SFA TOTALS :	0	89	417	1565	0	216	303	1405	0.9	1.1	172.6	39.7	334.6	80.2	1340.7	245.5
SFA 20: EASTERN SHORE																
COUNTRY HARBOUR				River Closed					0	N/A	0	N/A	0	N/A	1.8	N/A
EAST: SHEET HARBOUR	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.8	4.2	4.9
ECUM SECUM	0	0	3	7												
GUYSBOROUGH				River Closed					0	N/A	1.3	N/A	0	N/A	1.3	N/A
MOSER				River Closed					0	N/A	0.9	N/A	0	N/A	3.3	N/A
MUSQUODOBOIT	0	0	0	41	0	10	10	34	0	0	16.1	13.9	5.2	4.1	67.8	60.5
SAINT FRANCIS				River Closed					0	N/A	0	N/A	1.5	N/A	3	N/A
SAINT MARY'S	0	65	51	301	0	247	72	488	0.9	1.7	144.5	135.8	50	46.9	357.1	293.6
SALMON: GUYSBOROUGH CO.	0	17	20	44	0	2	0	43	0.3	0.9	16.8	19.9	7.5	7.5	50.7	28.2
SFA TOTALS :	0	82	75	393	0	259	82	564	1.2	2.5	179.2	127.2	63.4	44	482	331.1
SFA 21: SOUTHERN UPLANDS																
CLYDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8	1.5
GOLD				River Closed					0	N/A	0	N/A	0	N/A	1.3	N/A
JORDAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAHAVE	0	38	14	311	0	29	12	209	0	0	124.1	86	39.1	28.9	421.3	191
MEDWAY				River Closed					0	N/A	0.7	N/A	0	N/A	2.2	N/A
MERSEY	0	0	0	0	0	0	0	0	3.7	9.3	0.5	1.5	1.9	3.1	101	240
MIDDLE: LUNENBURG CO.				River Closed					0	N/A	1.5	N/A	0	N/A	3.1	N/A
MUSHAMUSH	0	0	0	0	0	0	0	0	0	0	0.9	1.7	0	0	2.3	4
PETITE RIVIERE	0	3	0	31	0	2	5	7	0	N/A	6.3	N/A	3.9	N/A	20.1	N/A
SACKVILLE	0	7	0	79	0	0	0	7	0	0	2.1	3.4	0	0	29.2	19.8
TUSKET	0	0	0	0	0	0	0	0	0	0	1	2.8	0.7	1.9	14.7	33.3
SFA TOTALS :	0	48	14	420	0	31	17	223	3.7	9.3	132	88.5	43.1	27.4	579.8	296.6

This Report is Available from the:

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